USB-TC

Thermocouple Measurement

User's Guide

Document Revision 9
January 2014

MEASUREMENT COMPUTING™

Your new Measurement Computing product comes with a fantastic extra —

Management committed to your satisfaction!

Thank you for choosing a Measurement Computing product—and congratulations! You own the finest, and you can now enjoy the protection of the most comprehensive warranties and unmatched phone tech support. It's the embodiment of our mission:

To provide data acquisition hardware and software that will save time and save money.

Simple installations minimize the time between setting up your system and actually making measurements. We offer quick and simple access to outstanding live FREE technical support to help integrate MCC products into a DAQ system.

Limited Lifetime Warranty: Most MCC products are covered by a limited lifetime warranty against defects in materials or workmanship for the life of the product, to the original purchaser, unless otherwise noted. Any products found to be defective in material or workmanship will be repaired, replaced with same or similar device, or refunded at MCC's discretion. For specific information, please refer to the terms and conditions of sale.

Harsh Environment Program: Any Measurement Computing product that is damaged due to misuse, or any reason, may be eligible for replacement with the same or similar device for 50% of the current list price. I/O boards face some harsh environments, some harsher than the boards are designed to withstand. Contact MCC to determine your product's eligibility for this program.

30 Day Money-Back Guarantee: Any Measurement Computing Corporation product may be returned within 30 days of purchase for a full refund of the price paid for the product being returned. If you are not satisfied, or chose the wrong product by mistake, you do not have to keep it.

These warranties are in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular application. The remedies provided herein are the buyer's sole and exclusive remedies. Neither Measurement Computing Corporation, nor its employees shall be liable for any direct or indirect, special, incidental or consequential damage arising from the use of its products, even if Measurement Computing Corporation has been notified in advance of the possibility of such damages.

Notice

Measurement Computing Corporation does not authorize any Measurement Computing Corporation product for use in life support systems and/or devices without prior written consent from Measurement Computing Corporation. Life support devices/systems are devices or systems that, a) are intended for surgical implantation into the body, or b) support or sustain life and whose failure to perform can be reasonably expected to result in injury. Measurement Computing Corporation products are not designed with the components required, and are not subject to the testing required to ensure a level of reliability suitable for the treatment and diagnosis of people.

Table of Contents

About this User's Guide

This user's guide describes the Measurement Computing USB-TC data acquisition device and lists device specifications.

Conventions in this user's guide

For more information

Text presented in a box signifies additional information related to the subject matter.

Caution! Shaded caution statements present information to help you avoid injuring yourself and others, damaging your hardware, or losing your data.

bold text — **Bold** text is used for the names of objects on a screen, such as buttons, text boxes, and check boxes.

italic text — *Italic* text is used for the names of manuals and help topic titles, and to emphasize a word or phrase.

Where to find more information

Additional information about USB-TC hardware is available on our website at www.mccdaq.com. You can also contact Measurement Computing Corporation by phone, fax, or email with specific questions.

- Knowledgebase: kb.mccdaq.com
- Phone: 508-946-5100 and follow the instructions for reaching Tech Support
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@mccdaq.com

Introducing the USB-TC

Overview: USB-TC features

The USB-TC is a USB 2.0 full-speed, thermocouple input module that is supported under popular Microsoft® Windows® operating systems. The USB-TC is fully compatible with both USB 1.1 and USB 2.0 ports.

The USB-TC provides eight differential thermocouple input channels. Eight independent, TTL-compatible digital I/O channels are provided to monitor TTL-level inputs, communicate with external devices, and to generate alarms. The digital I/O channels are software programmable for input or output.

With the USB-TC, you can take measurements from type J, K, R, S, T, N, E, and B thermocouples.

The USB-TC provides two integrated cold junction compensation (CJC) sensors for thermocouple measurements.

An open thermocouple detection feature lets you detect a broken thermocouple. An on-board microprocessor automatically linearizes the measurement data.

The USB-TC is a standalone plug-and-play module which draws power from the USB cable. No external power supply is required. All configurable options are software programmable.

The USB-TC is fully software calibrated.

Functional block diagram

USB-TC functions are illustrated in the block diagram shown here.

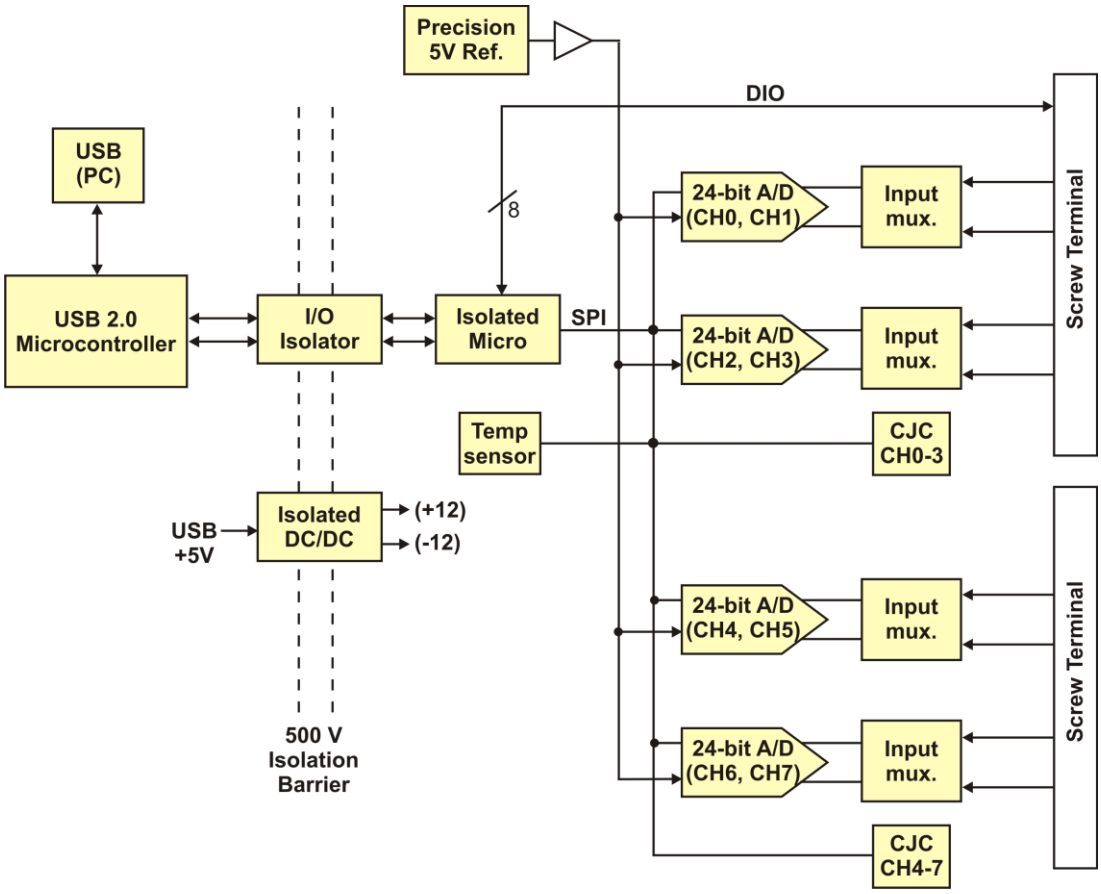

Figure 1. Functional block diagram

Connecting a USB-TC to your computer is easy

Installing a data acquisition device has never been easier.

- The USB-TC relies upon the Microsoft Human Interface Device (HID) class drivers. The HID class drivers ship with every copy of Windows that is designed to work with USB ports. We use the Microsoft HID because it is a standard, and its performance delivers full control and maximizes data transfer rates for your USB-TC. No third-party device driver is required.
- The USB-TC is plug-and-play. There are no jumpers to position, DIP switches to set, or interrupts to configure.
- You can connect the USB-TC before or after you install the software, and without powering down your computer first. When you connect an HID to your system, your computer automatically detects it and configures the necessary software. You can connect and power multiple HID peripherals to your system using a USB hub.
- You can connect your system to various devices using a standard four-wire cable. The USB connector replaces the serial and parallel port connectors with one standardized plug and port combination.
- You do not need a separate power supply module. The USB automatically delivers the electrical power required by each peripheral connected to your system.
- Data can flow two ways between a computer and peripheral over USB connections.

Installing the USB-TC

What comes with your shipment?

The following items are shipped with the USB-TC:

Hardware

- USB-TC
- USB cable

Software

- MCC DAQ CD

Documentation

In addition to this hardware user's guide, you should also receive the *Quick Start Guide*. This booklet provides an overview of the MCC DAQ software you received with the device, and includes information about installing the software. Please read this booklet completely before installing any software or hardware.

Unpacking

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the USB-TC from its packaging, ground yourself using a wrist strap or by simply touching the computer chassis or other grounded object to eliminate any stored static charge.

If any components are missing or damaged, contact us immediately using one of the following methods:

- Knowledgebase: kb.mccdaq.com
- Phone: 508-946-5100 and follow the instructions for reaching Tech Support
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@mccdaq.com

For international customers, contact your local distributor. Refer to the International Distributors section on our website at www.mccdaq.com/International.

Installing the software

Refer to the *Quick Start Guide* for instructions on installing the software on the MCC DAQ CD. This booklet is available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.

Installing the hardware

To connect the USB-TC to your system, turn your computer on, and connect the USB cable to a USB port on your computer or to an external USB hub that is connected to your computer. The USB cable provides power and communication to the USB-TC.

When you connect the USB-TC to a computer for the first time, a **Found New Hardware** dialog opens when the operating system detects the device. When the dialog closes, the installation is complete. The **USB LED** should blink and then remain on. This indicates that communication is established between the USB-TC and your computer.

Caution! Do not disconnect any device from the USB bus while the computer is communicating with the USB-TC, or you may lose data and/or your ability to communicate with the USB-TC.

If the LED turns off

If the LED is on but then turns off, the computer has lost communication with the USB-TC. To restore communication, disconnect the USB cable from the computer, and then reconnect it. This should restore communication, and the LED should turn back on.

Configuring the hardware

All hardware configuration options on the USB-TC are programmable with software. Use InstaCal to set the thermocouple type for each channel pair. Configuration options are stored on the USB-TC 's isolated microcontroller in EEPROM, which is non-volatile memory on the USB-TC module. Configuration options are loaded on power up. The factory default configuration is *Type J* thermocouple.

Warm up

Allow the USB-TC to warm up for 30 minutes before taking measurements. This warm up time minimizes thermal drift and achieves the specified rated accuracy of measurements.

Calibrating the hardware

The USB-TC is fully calibrated via InstaCal. Allow a 30 minute warm up before calibrating.

Sensor Connections

The USB-TC supports type J, K, R, S, T, N, E, and B thermocouples.

Thermocouple selection

The thermocouple type you select will depend on your application needs. Review the temperature ranges and accuracies of each type to determine which is best suited for your application.

Screw terminal pinout

The USB-TC has four rows of screw terminals — two rows on the top edge of the housing, and two rows on the bottom edge. Each row has 26 connections. Between each bank of screw terminals are two integrated CJC sensors used for thermocouple measurements. Signals are identified in Figure 2.

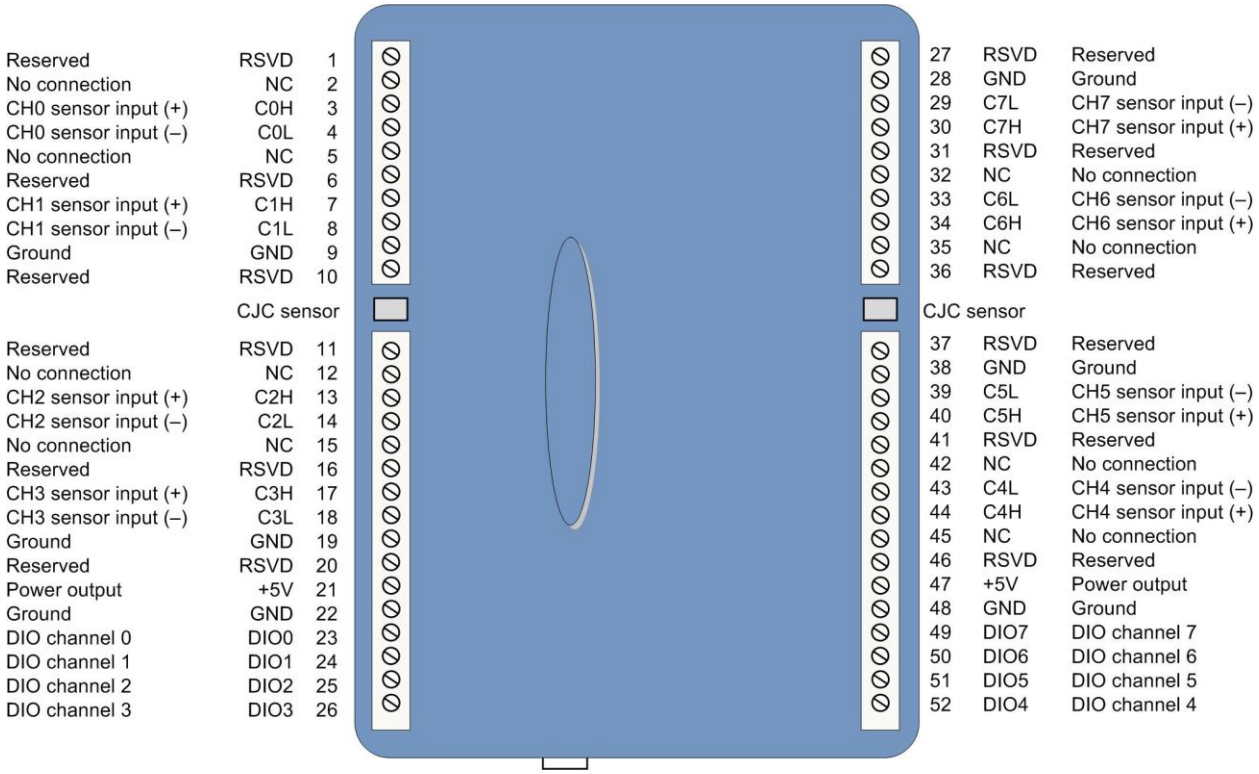

Figure 2. Screw terminal pinout

Use 16 AWG to 30 AWG wire for your signal connections.

Tighten screw terminal connections

When making connections to the screw terminals, be sure to tighten the screw until tight. Simply touching the top of the screw terminal is not sufficient to make a proper connection.

Thermocouple input

You can connect up to eight thermocouples to the differential sensor inputs (**C0H**/**C0L** to **C7H**/**C7L**). The device supports type J, K, R, S, T, N, E, and B thermocouples.

CJC sensors

The USB-TC has two built in high-resolution temperature sensors. One sensor is located on the right side of the package, and one sensor is located at the left side.

Digital I/O

You can connect up to eight digital I/O lines to the screw terminals labeled **DIO0** to **DIO7**. Each terminal is software configurable for input or output.

Power output

The two **+5V** terminals are isolated (500 VDC) from the USB +5V.

Caution! Each +5V terminal is an output. Do not connect to an external power supply or you may damage the USB-TC and possibly the computer.

Ground

The six analog ground terminals (**GND**) provide a common ground for the input channels and DIO bits and are isolated (500 VDC) from the USB GND.

Thermocouple connections

A thermocouple consists of two dissimilar metals that are joined together at one end. When the junction of the metals is heated or cooled, a voltage is produced that correlates to temperature.

The USB-TC makes fully differential thermocouple measurements without the need of ground-referencing resistors. A 32-bit floating point value in either a voltage or temperature format is returned by software. An open thermocouple detection feature is available for each analog input which automatically detects an open or broken thermocouple.

Use InstaCal to select the thermocouple type (J, K, R, S, T, N, E, and B) and one or more sensor input channels to connect the thermocouple.

Wiring configuration

Connect the thermocouple to the USB-TC using a differential configuration, as shown in Figure 3.

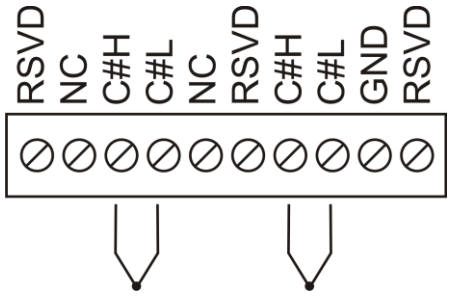

Figure 3. Typical thermocouple connection

Connect thermocouples to the USB-TC such that they are floating with respect to GND (pins 9, 19, 28, 38). The USB-TC **GND** pins are isolated from earth ground, so connecting thermocouple sensors to voltages referenced to earth ground is permissible as long as the isolation between the GND pins (9, 19, 28, 38) and earth ground is maintained.

When thermocouples are attached to conductive surfaces, the voltage differential between multiple thermocouples must remain within ±1.4 V. For best results, we recommend the use of insulated or ungrounded thermocouples when possible.

Maximum input voltage between analog input and ground

The absolute maximum input voltage between an analog input and the isolated GND pins is ±25 VDC when the device is powered on, and ±40 VDC when the device is powered off.

If you need to increase the length of your thermocouple, use the same type of thermocouple wires to minimize the error introduced by thermal EMFs.

Digital I/O connections

You can connect up to eight digital I/O lines to the screw terminals labeled **DIO0** to **DIO7**. You can configure each digital bit for either input or output. All digital I/O lines are pulled up to +5V with a 47 kΩ resistor (default). You can request the factory to configure the resistor for pull-down to ground if desired.

When you configure the digital bits for input, you can use the USB-TC digital I/O terminals to detect the state of any TTL-level input. Refer to the schematic shown in Figure 4. If you set the switch to the +5V input, DIO0 reads *TRUE* (1). If you move the switch to GND, DIO0 reads *FALSE* (0).

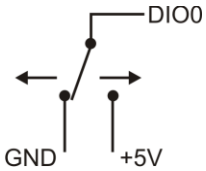

Figure 4. Schematic showing switch detection by digital channel DIO0

All ground pins are isolated from earth ground. If a connection is made to earth ground when using digital I/O and conductive thermocouples, the thermocouples are no longer isolated. In this case, thermocouples must not be connected to any conductive surfaces that may be referenced to earth ground

For general information regarding digital signal connections and digital I/O techniques, refer to the Guide to DAQ Signal Connections (available on our web site at www.mccdaq.com/signals/signals.pdf).

Functional Details

Thermocouple measurements

A thermocouple consists of two dissimilar metals that are joined together at one end. When the junction of the metals is heated or cooled, a voltage is produced that correlates to temperature.

The USB-TC hardware level-shifts the thermocouple's output voltage into the A/D's common mode input range by applying +2.5 V to the thermocouple's low side at the C#L input. Always connect thermocouple sensors to the USB-TC in a floating fashion. Do not attempt to connect the thermocouple low side C#L to GND or to a ground referencing resistor.

Cold junction compensation (CJC)

When you connect the thermocouple sensor leads to the sensor input channel, the dissimilar metals at the USB-TC terminal blocks produce an additional thermocouple junction. This junction creates a small voltage error term which must be removed from the overall sensor measurement using a cold junction compensation technique. The measured voltage includes both the thermocouple voltage and the cold junction voltage. To compensate for the additional cold junction voltage, the USB-TC subtracts the *cold junction* voltage from the thermocouple voltage.

The USB-TC has two high-resolution temperature sensors that are integrated into the design of the USB-TC. One sensor is located on the right side of the package, and one sensor is located at the left side. The CJC sensors measure the average temperature at the terminal blocks so that the cold junction voltage can be calculated. A software algorithm automatically corrects for the additional thermocouples created at the terminal blocks by subtracting the calculated cold junction voltage from the analog input's thermocouple voltage measurement.

Increasing the thermocouple length

If you need to increase the length of your thermocouple, use the same type of thermocouple wires to minimize the error introduced by thermal EMFs.

Data linearization

After the CJC correction is performed on the measurement data, an on-board microcontroller automatically linearizes the thermocouple measurement data using National Institute of Standards and Technology (NIST) linearization coefficients for the selected thermocouple type.

The measurement data is then output as a 32-bit floating point value in the configured format (voltage or temperature).

Open-thermocouple detection (OTD)

The USB-TC is equipped with an open-thermocouple detection for each analog input channel. With OTD, any open-circuit or short-circuit condition at the thermocouple sensor is detected by the software. An open channel is detected by driving the input voltage to a negative value outside the range of any thermocouple output. The software recognizes this as an invalid reading and flags the appropriate channel. The software continues to sample all channels when OTD is detected.

Input leakage current

With open-thermocouple detection enabled, 105 nA (max.) of input leakage current is injected into the thermocouple. This current can cause an error voltage to develop across the lead resistance of the thermocouple that is indistinguishable from the thermocouple voltage you are measuring. You can estimate this error voltage with the following formula:

error voltage = resistance of the thermocouple × 105 nA

To reduce the error, reduce the length of the thermocouple to lower its resistance, or lower the AWG of the wire by using a wire with a larger diameter. With open-thermocouple detection disabled, 30 nA (max.) of input leakage current is injected into the thermocouple.

USB connector

The USB connector provides +5V power and communication. No external power supply is required.

LED

The LED indicates the communication status of the USB-TC. It uses up to 5 mA of current. The table below defines the function of the USB-TC LED.

Illumination

LED Illumination	**Indication**
Steady green	The USB-TC is connected to a computer or external USB hub.
Blinking green	Data is being transferred. Upon connection, the LED blinks three times and then remains on; this indicates a successful installation.

Power

The two **+5V** terminals are isolated (500 VDC) from the USB +5V.

Caution! Each +5V terminal is an output. Do not connect to an external power supply or you may damage the USB-TC and possibly the computer.

Specifications

All specifications are subject to change without notice.
Typical for 25 °C unless otherwise specified.
Specifications in *italic* text are guaranteed by design.

Analog input

Table 1. Generic analog input specifications

Parameter	Condition	Specification
A/D converters		Four dual 24-bit, Sigma-Delta type
Number of channels		8 differential
Input isolation		*500 VDC minimum between field wiring and USB interface*
Channel configuration		Thermocouple sensor type
Differential input voltage range	Thermocouple	±0.080 V
Absolute maximum input voltage	*±C0x through ±C7x relative to GND (pins 9, 19, 28, 38)*	±24 V power on, ±24 V power off
Input impedance		5 GΩ, min
Input leakage current	Open thermocouple detect enabled	105 nA max
Normal mode rejection ratio	*f_{IN} = 60 Hz*	*90 dB min*
Common mode rejection ratio	*f_{IN} = 50 Hz/60 Hz*	*100 dB min*
Resolution		24 bits
No missing codes		*24 bits*
Input coupling		DC
Warm-up time		30 minutes min
Open thermocouple detect		Automatically enabled when the channel pair is configured for thermocouple sensors. The maximum open detection time is 3 seconds.
CJC sensor accuracy	*15 °C to 35 °C*	*±0.25 °C typ,* *±0.5 °C max*
	0 °C to 70 °C	*–1.0 to +0.5 °C max*

Channel configurations

Table 2. Channel configuration specifications

Sensor Category	Condition	Specification
Thermocouple	J, K, S, R, B, E, T, or N	8 differential channels

Note 1: Channel configuration information is stored in the EEPROM of the isolated microcontroller by the firmware whenever any item is modified. Modification is performed by commands issued over USB from an external application, and the configuration is made non-volatile through the use of the EEPROM.

Note 2: The factory default configuration is *Type J*.

Accuracy

Thermocouple measurement accuracy

Table 3. Thermocouple accuracy specifications, including CJC measurement error

Sensor Type	Maximum error (°C)	Typical error (°C)	Temperature range (°C)
J	±1.499	±0.507	–210 to 0
	±0.643	±0.312	0 to 1200
K	±1.761	±0.538	–210 to 0
	±0.691	±0.345	0 to 1372
S	±2.491	±0.648	–50 to 250
	±1.841	±0.399	250 to 1768.1
R	±2.653	±0.650	–50 to 250
	±1.070	±0.358	250 to 1768.1
B	±1.779	±0.581	250 to 700
	±0.912	±0.369	700 to 1820
E	±1.471	±0.462	–200 to 0
	±0.639	±0.245	0 to 1000
T	±1.717	±0.514	–200 to 0
	±0.713	±0.256	0 to 600
N	±1.969	±0.502	–200 to 0
	±0.769	±0.272	0 to 1300

Note 3: Thermocouple specifications include linearization, cold-junction compensation and system noise. These specs are for one year, or 3000 operating hours, whichever comes first and for operation of the device between 15 °C and 35 °C. For measurements outside this range, add ±0.5 degree to the maximum error shown. There are CJC sensors on each side of the module. The accuracy listed above assumes the screw terminals are at the same temperature as the CJC sensor. Errors shown do not include inherent thermocouple error. Please contact your thermocouple supplier for details on the actual thermocouple error.

Note 4: Thermocouples must be connected to the device such that they are floating with respect to GND. The GND pins are isolated from earth ground, so connecting thermocouple sensors to voltages referenced to earth ground is permissible as long as the isolation between the GND pins and earth ground is maintained.

Note 5: When thermocouples are attached to conductive surfaces, the voltage differential between multiple thermocouples must remain within ±1.4V. For best results we recommend the use of ungrounded or insulated thermocouples when possible.

Throughput rate

Table 4. Throughput rate specifications

Number of input channels	Maximum throughput
1	2 S/s
2	2 S/s on each channel, 4 S/s total
3	2 S/s on each channel, 6 S/s total
4	2 S/s on each channel, 8 S/s total
5	2 S/s on each channel, 10 S/s total
6	2 S/s on each channel, 12 S/s total
7	2 S/s on each channel, 14 S/s total
8	2 S/s on each channel, 16 S/s total

Note 6: The analog inputs are configured to run continuously. Each channel is sampled twice per second. The maximum latency between when a sample is acquired and the temperature data is provided by the USB unit is approximately 0.5 seconds.

Digital input/output

Table 5. Digital input/output specifications

Parameter	Specification
Digital type	CMOS
Number of I/O	8 (DIO0 through DIO7)
Configuration	Independently configured for input or output. Power on reset is input mode.
Pull-up/pull-down configuration	All pins pulled up to +5 V via 47 K resistors (default). Pull-down to ground (GND) also available.
Digital I/O transfer rate (software paced)	■ Digital input: 50 port reads or single bit reads per second, typ ■ Digital output: 100 port writes or single bit writes per second, typ
Input high voltage	2.0 V min, 5.5 V absolute max
Input low voltage	0.8 V max, –0.5 V absolute min
Output low voltage (IOL = 2.5 mA)	0.7 V max
Output high voltage (IOH = –2.5 mA)	3.8 V min

Note 7: All ground pins are isolated from earth ground. If a connection is made to earth ground when using digital I/O and conductive thermocouples, the thermocouples are no longer isolated. In this case, thermocouples must not be connected to any conductive surfaces that may be referenced to earth ground.

Memory

Table 6. Memory specifications

Parameter	Specification
EEPROM	1,024 bytes isolated micro reserved for sensor configuration 256 bytes USB micro for external application use

Microcontroller

Table 7. Microcontroller specifications

Parameter	Specification
Type	Two high performance 8-bit RISC microcontrollers

USB +5V voltage

Table 8. USB +5V voltage specifications

Parameter	Specification
USB +5V (VBUS) input voltage range	4.75 V min to 5.25 V max

Power

Table 9. Power specifications

Parameter	Condition	Specification
Supply current	USB enumeration	<100 mA
Supply current (Note 8)	Continuous mode	140 mA typ
User +5V output voltage range (pins 21 and 47)	Connected to self-powered hub. (Note 9)	4.75 V min to 5.25 V max
User +5V output current (pins 21 and 47)	Bus-powered and connected to a self-powered hub. (Note 9)	10 mA max
Isolation	Measurement system to PC	500 VDC min

Note 8: This is the total current requirement for the device which includes up to 10 mA for the status LED.

Note 9: Self-Powered Hub refers to a USB hub with an external power supply. Self-powered hubs allow a connected USB device to draw up to 500 mA.

Root Port Hubs reside in the PC USB Host Controller. The USB port(s) on your PC are root port hubs. All externally powered root port hubs (desktop PC's) provide up to 500 mA of current for a USB device. Battery-powered root port hubs provide 100 mA or 500 mA, depending upon the manufacturer. A laptop PC that is not connected to an external power adapter is an example of a battery-powered root port hub.

USB specifications

Table 10. USB specifications

Parameter	Specification
USB device type	USB 2.0 (full-speed)
Device compatibility	USB 1.1, USB 2.0
Device power capability	Self-powered, 100 mA consumption max
USB cable type	*A-B cable, UL type AWM 2725 or equivalent. (min 24 AWG VBUS/GND, min 28 AWG D+/D–)*
USB cable length	3 m (9.84 ft) max

Environmental

Table 11. Environmental specifications

Parameter	Specification
Operating temperature range	0 °C to 70 °C
Storage temperature range	–40 °C to 85 °C
Humidity	0% to 90% non-condensing

Mechanical

Table 12. Mechanical specifications

Parameter	Specification
Dimensions (L × W × H)	128.52 x 88.39 × 35.56 mm (5.06 × 3.48 × 1.43 ft)
User connection length	3 m (9.84 ft) max

Signal connector

Table 13. Signal connector specifications

Parameter	Specification
Connector type	Screw terminal
Wire gauge range	16 AWG to 30 AWG

Table 14. Screw terminal pinout

Pin	Signal Name	Pin Description	Pin	Signal Name	Pin Description
1	RSVD	Reserved, Do Not Use	27	RSVD	Reserved, Do Not Use
2	NC	No connection	28	GND	Ground
3	C0H	CH0 sensor input (+)	29	C7L	CH7 sensor input (–)
4	C0L	CH0 sensor input (–)	30	C7H	CH7 sensor input (+)
5	NC	No connection	31	RSVD	Reserved, Do Not Use
6	RSVD	Reserved, Do Not Use	32	NC	No connection
7	C1H	CH1 sensor input (+)	33	C6L	CH6 sensor input (–)
8	C1L	CH1 sensor input (–)	34	C6H	CH6 sensor input (+)
9	GND	Ground	35	NC	No connection
10	RSVD	Reserved, Do Not Use	36	RSVD	Reserved, Do Not Use
	CJC sensor			CJC sensor	
11	RSVD	Reserved, Do Not Use	37	RSVD	Reserved, Do Not Use
12	NC	No connection	38	GND	Ground
13	C2H	CH2 sensor input (+)	39	C5L	CH5 sensor input (–)
14	C2L	CH2 sensor input (–)	40	C5H	CH5 sensor input (+)
15	NC	No connection	41	RSVD	Reserved, Do Not Use
16	RSVD	Reserved, Do Not Use	42	NC	No connection
17	C3H	CH3 sensor input (+)	43	C4L	CH4 sensor input (–)
18	C3L	CH3 sensor input (–)	44	C4H	CH4 sensor input (+)
19	GND	Ground	45	NC	No connection
20	RSVD	Reserved, Do Not Use	46	RSVD	Reserved, Do Not Use
21	+5V	+5V output	47	+5V	+5V output
22	GND	Ground	48	GND	Ground
23	DIO0	DIO channel 0	49	DIO7	DIO channel 7
24	DIO1	DIO channel 1	50	DIO6	DIO channel 6
25	DIO2	DIO channel 2	51	DIO5	DIO channel 5
26	DIO3	DIO channel 3	52	DIO4	DIO channel 4

CE Declaration of Conformity

Manufacturer: Measurement Computing Corporation
Address: 10 Commerce Way
Suite 1008
Norton, MA 02766
USA

Category: Electrical equipment for measurement, control and laboratory use.

Measurement Computing Corporation declares under sole responsibility that the product

USB-TC

to which this declaration relates is in conformity with the relevant provisions of the following standards or other documents:

EC EMC Directive 2004/108/EC: General Requirements, EN 61326-1:2006 (IEC 61326-1:2005).

Emissions:

- EN 55011 (2007) / CISPR 11(2003): Radiated emissions: Group 1, Class A
- EN 55011 (2007) / CISPR 11(2003): Conducted emissions: Group 1, Class A

Immunity: EN 61326-1:2006, Table 3.

- IEC 61000-4-2 (2001): Electrostatic Discharge immunity.
- IEC 61000-4-3 (2002): Radiated Electromagnetic Field immunity.

To maintain compliance to the standards of this declaration, the following conditions must be met.

- The host computer, peripheral equipment, power sources, and expansion hardware must be CE compliant.
- All I/O cables must be shielded, with the shields connected to ground.
- I/O cables must be less than 3 meters (9.75 feet) in length.
- The host computer must be properly grounded.
- The host computer must be USB 2.0 compliant.
- Equipment must be operated in a controlled electromagnetic environment as defined by Standards EN 61326-1:2006, or IEC 61326-1:2005.

Note: Data acquisition equipment may exhibit noise or increased offsets when exposed to high RF fields (>1V/m) or transients.

Declaration of Conformity based on tests conducted by Chomerics Test Services, Woburn, MA 01801, USA in April, 2005. Test records are outlined in Chomerics Test Report #EMI4193.05. Further testing was conducted by Chomerics Test Services, Woburn, MA. 01801, USA in December, 2008. Test records are outlined in Chomerics Test Report #EMI5215B.08.

We hereby declare that the equipment specified conforms to the above Directives and Standards.

Carl Haapaoja, Director of Quality Assurance

Measurement Computing Corporation
10 Commerce Way
Suite 1008
Norton, Massachusetts 02766
(508) 946-5100
Fax: (508) 946-9500
E-mail: info@mccdaq.com
www.mccdaq.com